



## General

### Guideline Title

Quality improvement guidelines for pediatric abscess and fluid drainage.

### Bibliographic Source(s)

Hogan MJ, Marshall FE, Sidhu MK, Connolly BL, Towbin RB, Saad WA, Cahill AM, Crowley J, Heran MK, Hohenwarter EJ, Roebuck DJ, Temple MJ, Walker TG, Cardella JF, Society of Interventional Radiology Standards of Practice Committee, Society for Pediatric Radiology Interventional Radiology Committee. Quality improvement guidelines for pediatric abscess and fluid drainage. J Vasc Interv Radiol. 2012 Nov;23(11):1397-402. [63 references] [PubMed](#)

### Guideline Status

This is the current release of the guideline.

## Regulatory Alert

### FDA Warning/Regulatory Alert

Note from the National Guideline Clearinghouse: This guideline references a drug(s) for which important revised regulatory and/or warning information has been released.

- [December 14, 2016 – General anesthetic and sedation drugs](#) : The U.S. Food and Drug Administration (FDA) is warning that repeated or lengthy use of general anesthetic and sedation drugs during surgeries or procedures in children younger than 3 years or in pregnant women during their third trimester may affect the development of children's brains. Consistent with animal studies, recent human studies suggest that a single, relatively short exposure to general anesthetic and sedation drugs in infants or toddlers is unlikely to have negative effects on behavior or learning. However, further research is needed to fully characterize how early life anesthetic exposure affects children's brain development.

## Recommendations

### Major Recommendations

#### Pediatric Abscess and Fluid Drainage

#### Indications

Because of the variability in the presentation of abscesses and fluid collections, the indications for drainage or aspiration must be stated in general

terms. These general indications include the presence of a fluid collection, and one of the following:

1. Suspicion that the collection is infected
2. Need for fluid characterization
3. Suspicion that the collection is producing symptoms sufficient to warrant drainage

Most collections are found after an imaging study is performed, when their existence is suspected from physical examination and/or laboratory studies. Additional studies may be required to confirm the presence or nature of the fluid collection and to evaluate the feasibility of drainage.

Diagnostic aspiration may be the only means of determining that a collection is infected, as physical examination and laboratory studies may be conflicting or nondiagnostic. If infection is suspected during aspiration, a drainage catheter may be placed.

Although image-guided aspiration and drainage can almost universally be performed, the potential complications, as well as the medical and surgical alternatives, should be weighed with respect to the potential benefit. Potential complicating factors such as coagulopathy or complex drainage routes (e.g., deep abscess with bowel or other organs interposed between the site of access and the abscess) must be recognized, evaluated, and corrected if necessary and if possible. Multiple abscesses may be better approached by surgery, although practice may be evolving toward treatment with multiple percutaneous drains.

### Etiologies

Fluid collections and abscesses can occur anywhere in the body. In children, the most common cause of intraabdominal abscesses is appendicitis. Children with appendicitis are more likely to present with perforation and abscesses than adults. Primary drainage is frequently performed as an alternative to initial surgery, which allows the patient to recover from their acute infection. Some surgeons subsequently perform laparoscopic surgery to remove the appendix. Postoperative abscesses also occur after appendectomy and other abdominal surgeries; image-guided procedures in these situations are a valuable option, as surgical alternatives carry significant morbidity in the postoperative abdomen. Other etiologies for pediatric abdominal fluid collections include Crohn disease, cerebrospinal fluid pseudocysts, abscesses from necrotizing enterocolitis, posttraumatic collections, acalculous cholecystitis, and various causes that are encountered in the adult population.

Image-guided percutaneous drainage of pleural effusions and empyemas is commonly performed in children, often with the instillation of thrombolytic agents. Pulmonary abscesses and infected congenital cystic adenomatoid malformations can also be drained via percutaneous catheters.

Soft tissue and musculoskeletal drainage indications include septic joints/joint effusions, abscesses from cellulitis and other soft-tissue infections, aspiration of suspected osteomyelitis, and infected congenital cystic lesions such as lymphatic malformations, thyroglossal duct cysts, and branchial cleft cysts. The drainage of congenital cystic lesions may also be the initial step in performing therapeutic sclerotherapy as a definitive treatment.

### Preprocedural Evaluation

Most collections are identified by an imaging study. It is important that these imaging studies be tailored to the patients' symptoms, possible diagnoses, and potential treatment options including the best access approach. Ultrasound (US) should be used whenever possible. This will spare the patient potential radiation exposure, which is a critical concern in children. If a computed tomography (CT) scan is the study of choice, it should be performed with the lowest radiation dose possible, and be protocolized to answer all the necessary questions listed earlier in a single study.

Before a potential drainage procedure is performed, it is necessary to carefully review the indications and communicate with the referring service to ensure that the patient is receiving the most appropriate treatment. In general, given the procedural, sedation, and radiation risks to children, more time is spent in communication with referring teams, consulting services, and the family before procedures than for comparable adult procedures. A detailed informed consent must be obtained from the parents or guardians.

Preprocedural laboratory tests such as an international normalized ratio (INR) and platelet count may be helpful in the patient with a suspected bleeding tendency, and are required in a patient with a known bleeding disorder. Additionally, if an organ will be traversed such as transhepatic access for a cholecystostomy tube, these laboratory tests should be obtained. If the patient is coagulopathic, oral vitamin K, fresh frozen plasma, cryoprecipitate, or platelet transfusion may be indicated. In the case of transfusions, it is important that they be provided immediately before or during the case to optimize protective effects of the transfusion. General guidelines are that elective procedures can be performed safely with a platelet count of more than 50,000 platelets/ $\mu$ L and an INR lower than 1.2, with an INR lower than 1.5 preferred for urgent cases.

The administration of intravenous antibiotics may be indicated, as manipulation of an infected collection may precipitate septicemia. The use and type of antibiotics should be determined based on the expected pathogens and clinical need.

### Radiation Protection

Children are more radiation-sensitive than adults and have a longer lifespan during which to manifest radiation-induced cancers. Although abscess drainage procedures are not usually one of the procedures in pediatric interventional radiology associated with high radiation dose, lengthy or repeated procedures may nevertheless result in significant radiation exposure. In addition, many abscesses are located near radiation-sensitive organs such as the gonads (in the case of pelvic abscess), thyroid, breast, or orbits in children. It is prudent and important to use appropriate radiation safety techniques when performing pediatric interventional procedures. As an additional benefit, reducing the radiation exposure to the patient also reduces exposure to operator and ancillary personnel, for whom the largest source of radiation is scatter from the patient.

Many pediatric patients are smaller than adults, which reduces the total amount of scatter dose. However, other factors increase operator dose, such as magnification use during certain procedures, which generally increases patient and operator dose; the small size of the patient may require the operator to stand closer to the x-ray source and may make it difficult to keep their hands out of the primary beam during certain portions of the procedure.

Some techniques for decreasing patient radiation dose include substituting US for CT or fluoroscopy when feasible, using reduced-dose pediatric CT protocols, using the last image hold feature to view anatomy rather than live fluoroscopy, using pulsed fluoroscopy, tightly collimating to the area of interest, minimizing the use of magnification, and optimally positioning the patient away from the x-ray source.

### Sedation and Anesthesia

Most children will not be able to cooperate with an interventional procedure without some form of sedation or anesthesia to ensure a successful and safe outcome. Choice and route of sedation must be decided in those patients requiring this support. Although select situations and patients may require only local anesthetic administration, most will likely require a higher level of sedation than in adults, and possibly general anesthesia. Topical anesthetic creams are useful adjuncts for patients undergoing conscious sedation, to lessen the painful sensation caused by local anesthetic infiltration. The interventionalist must help plan for this, and decide what level of support the patient needs, given patient age and pain tolerance, difficulty and duration of the procedure, and expected level of procedural pain. General anesthesia may be preferred when airway management is an issue, or in patients in whom previous attempts at sedation have failed. Moderate sedation can be performed under the supervision of medical personnel trained in pediatric sedation, whereas deep sedation may be aided by the use of a dedicated sedation service or the anesthesia department.

### Patient Care Issues

Maintaining the appropriate homeostatic and monitoring environment during the procedure is of paramount importance. As young children, especially those younger than 2 years of age, are very susceptible to ambient temperature changes, temperature monitoring is recommended. Some procedures in critically ill neonates may best be performed in the neonatal or pediatric intensive care unit to maximize patient support. Patient size-specific leads and probes for routine electrocardiography, blood pressure, and respiratory monitoring are required, with proper padding of pressure points to minimize nerve palsies. Appropriate patient immobilization for safety is also important.

### Contraindications

It is mandatory that a discussion with the patient and/or family and referring physicians takes place before the procedure. As discussed previously, coagulopathies should be evaluated and corrected if possible. If access is not possible without traversing organs such as bowel, a trial of antibiotic therapy, simple needle aspiration, or surgical treatment are options. As with all procedures, the benefits of drainage should be weighed with regard to the patient's overall clinical status.

### Image Guidance and Approach

The choice of imaging used for guidance is based on which modality provides the safest procedure with the highest likelihood of success. US guidance is by far the most common in children. The smaller body habitus of most children allows for better visualization during imaging guidance. The multiplanar capability of freehand imaging allows for many choices of access site and trajectory. As discussed previously, the use of US eliminates radiation exposure. However, US may not be the optimal imaging modality in certain circumstances. The presence of intervening air or bone limits the effectiveness of US. If either air or bone is between the transducer and the collection, CT guidance may be required. In obese patients, US may not provide adequate visualization. In addition, certain techniques and situations may be better suited to alternative guidance. Transgluteal drainage can be performed best with CT guidance. Drainage of loculated or complex pneumothoraces or pneumatocèles may be better achieved with CT or fluoroscopic guidance.

Pediatric patients range in weight from less than 600 g to greater than 200 kg. This diversity requires that many different transducers be available, and the US machine must be of sufficient quality to image all these patients.

Although fluoroscopy is typically used during guide wire placement, tract dilation, and catheter deployment, US may be substituted to eliminate radiation exposure.

Alternative percutaneous approaches are possible when imaging demonstrates a potential anatomic challenge such as interposed organs, bowel, or blood vessels, or when another approach is easier to perform. For deep pelvic abscesses, transgluteal and transrectal approaches are both possible in children, with the choice of approach dependent on the interventionalist. Transrectal drainage in children is usually similar to that in adults. However, if the child is small, the endocavitary probe may not fit into the rectum. For these patients, the imaging is typically transabdominal. The advancement of the needle or catheter through the rectum into the abscess can be visualized through the bladder as an acoustic window. Techniques have been described to protect the rectal mucosa from the needle or catheter during advancement.

## Procedure

Percutaneous drain insertion follows the technique of surgical drainage, whereby the route of drainage should avoid normal adjacent structures such as nerve bundles, blood vessels, bowel, pleura, and lung. Small collections (<3 cm in diameter) may be aspirated, whereas larger abscesses will usually require indwelling drain placement. Catheter insertion can be performed by using a trocar or Seldinger technique. In the trocar technique, the catheter is loaded onto a needle, which, with imaging guidance, is used to puncture the abscess cavity. The catheter is then advanced over the needle into the cavity. The main advantage of the trocar technique is that it is quick and essentially involves one step. This technique can therefore be used in patients who are not deeply sedated, as a bedside technique in critically ill patients, and for a large fluid collection with a straightforward access trajectory. The main disadvantage is that the trocar technique can result in a less-than-optimal catheter position and increased complication risk if the correct trajectory is not chosen. Risks are minimized in the hands of experienced operators, and when the trocar technique is used in conjunction with fluoroscopy. In the pediatric population, it is an effective technique when used for transrectal abscess drain insertion.

In the Seldinger technique, the fluid collection is punctured with a needle by using image guidance. Typically, an appropriately sized single-wall needle or sheathed needle is used that allows for passage of a 0.035-inch guide wire into the fluid collection. If a 21-gauge needle/0.018-inch guide wire combination is used for initial access, exchange to a 0.035-inch guide wire will be required. After serial dilation of the tract, the catheter is placed over the wire and formed within the collection using US or fluoroscopic guidance. Use of a small-caliber needle for initial puncture is of value when the window to avoid nearby structures is small, resulting in a difficult access. The Seldinger technique is more controlled and can result in less risk to nearby structures, but becomes difficult when there is increased tissue mobility (e.g., nephrostomy insertion, suprapubic catheter insertion, and drainage of lymphatic malformations). It can also result in more leakage of body fluids around the indwelling wire during dilator/catheter exchange, potentially causing contamination of the field and reduction in size of the abscess cavity, making catheter insertion more difficult. It can be more painful as a result of the number of steps involved, and consequently adequate sedation is essential. The Seldinger technique combined with image guidance will ensure proper catheter placement and positioning. In the thorax, CT or fluoroscopy may be required, as the presence of air may limit the effectiveness of US.

Typically, depending on the size of the patient and the characteristics of the collection, 6–14-F catheters can be successfully placed by using a percutaneous route. Locking-loop drainage catheters are often used to prevent catheter dislodgment. In very young children and for drainage of small collections, smaller French size catheters and a smaller diameter of the locking loop are important, as a standard-diameter locking loop may not form properly. After placement, the catheter is then secured with an anchoring suture and/or an adhesive device. Catheter surveillance and maintenance should include output monitoring, and many operators will flush the catheter with 3–10 mL of sterile 0.9% saline solution every 8 to 12 hours to maintain patency and insure drainage. Depending on the size of the collection, the administration of intracavitary tissue plasminogen activator in a dose ranging from 2 mg to 10 mg mixed with 20–50 mL of normal saline solution can be effective in facilitating drainage of a complex collection. Therapy can be performed on an as-needed basis or on a set regimen (e.g., twice daily for a few days) with good result. Alternatively, the drain can be exchanged for a larger size over a guide wire.

## Success Rates and Thresholds

Successful diagnostic fluid aspiration is defined as the aspiration of material sufficient for diagnosis. The suggested threshold for aspiration of adequate fluid for diagnostic characterization is 95%. Success rates and thresholds are summarized in Table 1 in the original guideline document.

Curative drainage is defined as complete resolution of infection requiring no further operative intervention. Curative drainage has been achieved in more than 80% of patients. Partial success is defined as adequate drainage of the abscess with surgery subsequently performed to repair an underlying problem or as temporizing drainage performed to stabilize the patient's condition before surgery. Partial success occurs in 5% to 10% of patients. Failure occurs in 5% to 10% and recurrence in 5% to 10%. These results are similar for abdominal and chest drainage procedures. These success rates will depend on the proportion of collections drained in patients with relative contraindications, on the complexity of the collection, and on the severity of the underlying medical problems. The suggested threshold for curative and partial success is 85% (see Table 1 in the original guideline document).

## *Drainage of Infected Collections*

Because of the variability of the types of infected collections, the success rate of drainage will be highly variable, and it is not believed that a specific threshold for success in drainage of infected collections can be set.

See the "Potential Harms" field and the original guideline document for information on complications of the fluid drainage.

### Summary

Image-guided drainage of abscesses and fluid collections is a valuable tool in the treatment of pediatric patients. It may obviate surgery or optimize the child's clinical condition for subsequent surgery. Compared with adults, several differences exist in terms of etiology, risks (especially radiation exposure), preprocedural imaging and planning, technical considerations, support issues such as sedation, and complications. Knowledge of these differences is important in the planning and treatment of these patients. In addition, a quality improvement plan can be used to assess practice performance.

## Clinical Algorithm(s)

None provided

## Scope

## Disease/Condition(s)

Pediatric abscesses and fluid collections

## Guideline Category

Management

Risk Assessment

## Clinical Specialty

Anesthesiology

Critical Care

Family Practice

Gastroenterology

Pediatrics

Radiology

Surgery

## Intended Users

Advanced Practice Nurses

Allied Health Personnel

Nurses

Physician Assistants

Physicians

## Guideline Objective(s)

To provide guidelines for quality improvement of pediatric abscess and fluid drainage

## Target Population

Pediatric population requiring abscess and liquid drainage

## Interventions and Practices Considered

1. Evaluating potential risks and benefits of abscess and fluid drainage
2. Preprocedural evaluation
  - Ultrasound (US)
  - Computed tomography (CT)
  - Evaluating appropriateness of procedure
  - Obtaining informed consent
  - Laboratory tests, including international normalized ratio (INR) and platelet count
  - Intravenous antibiotics
3. Radiation protection
4. Appropriate sedation and anesthesia
5. Patient care issues (e.g., maintaining appropriate homeostatic and monitoring environment during the procedure)
6. Consideration of contraindications
7. Choice of imaging used for guidance (US, CT, fluoroscopy) and approach
8. Procedure for percutaneous drain insertion
  - Trocars
  - Seldinger technique

## Major Outcomes Considered

- Success rates of diagnostic fluid aspiration
- Success rates of curative drainage
- Partial success rates
- Procedure complications

## Methodology

### Methods Used to Collect/Select the Evidence

Searches of Electronic Databases

### Description of Methods Used to Collect/Select the Evidence

An in-depth literature search was performed by using electronic medical literature databases (mainly PubMed searching with no prior date restriction and up to 2012). Search terms included *pediatric*, *children*, *abscess*, *drainage*, *drain*, *pseudocyst*, and *cyst*. No inclusion/exclusion criteria were used during the search.

### Number of Source Documents

Not stated

## Methods Used to Assess the Quality and Strength of the Evidence

Not stated

## Rating Scheme for the Strength of the Evidence

Not applicable

## Methods Used to Analyze the Evidence

Systematic Review with Evidence Tables

## Description of the Methods Used to Analyze the Evidence

A critical review of peer-reviewed articles is performed with regard to the study methodology, results, and conclusions. The qualitative weight of these articles is assembled into an evidence table, which is used to write the document such that it contains evidence-based data with respect to content, complication rates, outcomes, and thresholds for prompting quality assurance reviews.

## Methods Used to Formulate the Recommendations

Expert Consensus (Delphi)

## Description of Methods Used to Formulate the Recommendations

Standards documents of relevance and timeliness are conceptualized by the Standards of Practice Committee members. A recognized expert is identified to serve as the principal author for the standard. Additional authors may be assigned dependent upon the magnitude of the project.

When the evidence of literature is weak, conflicting, or contradictory, consensus for the parameter is reached by a minimum of 12 Standards of Practice Committee members using a modified Delphi consensus method. For purposes of these documents, consensus is defined as 80% Delphi participant agreement on a value or parameter.

Reported complication-specific rates in some cases reflect the aggregate of major and minor complications. Thresholds are derived from critical evaluation of the literature, evaluation of empirical data from Standards of Practice Committee members' practices, and, when available, the Society of Interventional Radiology (SIR) HI-IQ® System national database.

## Rating Scheme for the Strength of the Recommendations

Not applicable

## Cost Analysis

A formal cost analysis was not performed and published cost analyses were not reviewed.

## Method of Guideline Validation

External Peer Review

Internal Peer Review

## Description of Method of Guideline Validation

The draft document is critically reviewed by the Standards of Practice Committee members, either by telephone conference calling or face-to-face meeting. The finalized draft from the Committee is sent to the Society of Interventional Radiology (SIR) membership for further input/criticism during a 30-day comment period. These comments are discussed by the Standards of Practice Committee, and appropriate revisions made to create the finished standards document. Before its publication, the document is endorsed by the SIR Executive Council.

## Evidence Supporting the Recommendations

### Type of Evidence Supporting the Recommendations

The type of evidence supporting the recommendations is not specifically stated.

## Benefits/Harms of Implementing the Guideline Recommendations

### Potential Benefits

Image-guided drainage of abscesses and fluid collection may obviate surgery or optimize the child's clinical condition for subsequent surgery.

### Potential Harms

- Specific major complications (refer to the "Complications" section in the original guideline document for additional information):
  - Septic shock - 1%–2%
  - Bacteremia requiring significant new intervention - 2%–5%
  - Hemorrhage requiring transfusion - 1%
  - Superinfection (includes infection of sterile fluid collection) - 1%
  - Bowel transgression requiring intervention - 1%
  - Pleural transgression requiring intervention (abdominal procedures) - 1%
  - Pleural transgression requiring additional intervention (chest procedures) - 2%–10%
- Children are more radiation-sensitive than adults and have a longer lifespan during which to manifest radiation-induced cancers. Although abscess drainage procedures are not usually one of the procedures in pediatric interventional radiology associated with high radiation dose, lengthy or repeated procedures may nevertheless result in significant radiation exposure. In addition, many abscesses are located near radiation-sensitive organs such as the gonads (in the case of pelvic abscess), thyroid, breast, or orbits in children.
- The main disadvantage of the trocar technique is that it can result in a less-than-optimal catheter position and increased complication risk if the correct trajectory is not chosen. Risks are minimized in the hands of experienced operators, and when the trocar technique is used in conjunction with fluoroscopy.
- The Seldinger technique becomes difficult when there is increased tissue mobility (e.g., nephrostomy insertion, suprapubic catheter insertion, and drainage of lymphatic malformations). It can also result in leakage of body fluids around the indwelling wire during dilator/catheter exchange, potentially causing contamination of the field and reduction in size of the abscess cavity, making catheter insertion more difficult. It can be more painful than the trocar technique as a result of the number of steps involved, and consequently adequate sedation is essential.
- Because pediatric patients typically need a higher level of sedation for a safe and successful procedure, complications from sedation and anesthesia may occasionally occur. Although the risks of general anesthesia are low, they can be major, especially in patients with compromised cardiopulmonary function. The majority of complications seen with general anesthesia in these patients are minor, with postoperative nausea and vomiting the most common issue. Careful communication with anesthesiologists before draining intraparenchymal lung abscesses is very important because of the risk of dissemination of the abscess contents into the ipsilateral, and even the contralateral, lung.
- Coagulopathies should be evaluated and corrected if possible. If access is not possible without traversing organs such as bowel, a trial of antibiotic therapy, simple needle aspiration, or surgical treatment are options. As with all procedures, the benefits of drainage should be weighed with regard to the patient's overall clinical status.

## Qualifying Statements



## Qualifying Statements

The clinical practice guidelines of the Society of Interventional Radiology (SIR) attempt to define practice principles that generally should assist in producing high quality medical care. These guidelines are voluntary and are not rules. A physician may deviate from these guidelines, as necessitated by the individual patient and available resources. These practice guidelines should not be deemed inclusive of all proper methods of care or exclusive of other methods of care that are reasonably directed towards the same result. Other sources of information may be used in conjunction with these principles to produce a process leading to high quality medical care. The ultimate judgment regarding the conduct of any specific procedure or course of management must be made by the physician, who should consider all circumstances relevant to the individual clinical situation. Adherence to the SIR Quality Improvement Program will not assure a successful outcome in every situation. It is prudent to document the rationale for any deviation from the suggested practice guidelines in the department policies and procedure manual or in the patient's medical record.

## Implementation of the Guideline

### Description of Implementation Strategy

An implementation strategy was not provided.

## Institute of Medicine (IOM) National Healthcare Quality Report Categories

### IOM Care Need

Getting Better

### IOM Domain

Effectiveness

Patient-centeredness

Safety

## Identifying Information and Availability

### Bibliographic Source(s)

Hogan MJ, Marshalleck FE, Sidhu MK, Connolly BL, Towbin RB, Saad WA, Cahill AM, Crowley J, Heran MK, Hohenwarter EJ, Roebuck DJ, Temple MJ, Walker TG, Cardella JF, Society of Interventional Radiology Standards of Practice Committee, Society for Pediatric Radiology Interventional Radiology Committee. Quality improvement guidelines for pediatric abscess and fluid drainage. J Vasc Interv Radiol. 2012 Nov;23(11):1397-402. [63 references] [PubMed](#)

### Adaptation

Not applicable: The guideline was not adapted from another source.

### Date Released

## Guideline Developer(s)

Society for Pediatric Radiology - Medical Specialty Society

Society of Interventional Radiology - Medical Specialty Society

## Source(s) of Funding

Society of Interventional Radiology

## Guideline Committee

Society of Interventional Radiology Standards of Practice Committee

Society for Pediatric Radiology Interventional Radiology Committee

## Composition of Group That Authored the Guideline

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## Financial Disclosures/Conflicts of Interest

W.A.S. has research funded by Siemens (Forchheim, Germany) and is a paid consultant for Boston Scientific (Natick, Massachusetts). None of the other authors have identified a conflict of interest.

## Guideline Status

This is the current release of the guideline.

## Guideline Availability

Electronic copies: Available from the [Society of Interventional Radiology Web site](#) .

Print copies: Available from the Society of Interventional Radiology, 10201 Lee Highway, Suite 500, Fairfax, VA 22030

## Availability of Companion Documents

None available

## Patient Resources

None available

## NGC Status

This NGC summary was completed by ECRI Institute on January 23, 2015. This summary was updated by ECRI Institute on February 15, 2017 following the U.S. Food and Drug Administration advisory on general anesthetic and sedation drugs.

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